## Amendments to the Drawings:

The attached replacement drawing sheet makes changes to Figs. 3(a)-(c) and replaces the original sheet with Figs. 3(a)-(c).

## REMARKS

Claims 10, 14, 18, 22, 26 and 27 are pending in this application. By this Amendment, claim 10 and Figures 3(a)-(c) are amended, and claims 11-13, 15-17, 19-21 and 23-25 are canceled. Support for the amendments to claim 10 and Figures 3(a)-(c) may be found, for example, in the specification on page 17, line 1 to page 18, line 5. No new matter is added. In view of the foregoing amendments and following remarks, reconsideration and allowance are respectfully requested.

### I.    Rejection Under 35 U.S.C. §112

The Office Action rejects claims 10-27 under 35 U.S.C. §112, second paragraph, as allegedly being indefinite for failing to particularly point out and distinctly claims the subject matter which Applicant regards as the invention. By this amendment, claims 11-13, 15-17, 19-21 and 23-25 are canceled, thereby rendering their rejection moot. As to the remaining claims, the rejection is respectfully traversed.

#### A.    Claim 10

The Office Action rejects claim 10 as allegedly lacking antecedent basis for "the melting point of the raw material." Without conceding to the propriety of the rejection, by this Amendment, claim 10 is amended to recite "a melting point of the raw material." Accordingly, reconsideration and withdrawal of the rejection are respectfully requested.

#### B.    Claims 11-13

Office Action rejects claims 11-13, alleging that it is "not defined how the value with the V/G is controlled within a range which has a different unit value with the V/G." See pages 3 and 4 of the Office Action. By this Amendment, claims 11-13 are canceled, thereby rendering their rejection moot. To the extent that the rejection may apply to amended claim 10, the rejection is respectfully traversed.

Controlling a value of V/G within a determined range as a function of Tmax is described in the specification on page 16, line 17 to page 17, line 21, and is also shown in Figures 3(a)-(c). In Figures 3(a)-(c), each of the mathematical expressions from $-0.000724$ [mm$^2$/(°C •K • min)] x Tmax (°C) + 1.31 (mm$^2$/K • min); $-0.000724$ [mm$^2$/(°C •K • min)] x Tmax (°C) + 1.35 (mm$^2$/K • min); and $-0.000724$ [mm$^2$/(°C •K • min)] x Tmax (°C) + 1.38 (mm$^2$/K • min) represent a linear relationship between Tmax (°C) and V/G (mm$^2$/K • min). In the standard linear equation $y = ax + b$, y is the value of V/G (mm$^2$/K • min); x is Tmax (°C); a is the slope $-0.000724$ [mm$^2$/(°C •K • min)]; and b is one of the y-intercepts 1.31 (mm$^2$/K • min) ; 1.35 (mm$^2$/K • min); or 1.38 (mm$^2$/K • min). These expressions clearly show how a value of V/G is controlled within the recited ranges of Tmax. Applicants respectfully submit that one of skill in the art would instantly appreciate these concepts from a perusal of the specification and figures. However, in the interest of advancing prosecution, the recitations of the mathematical expressions in amended claim 10 include the units for the slope, Tmax, and the y-intercept. Thus, claim 10 is believed to fully comply with the provisions of 35 U.S.C. §112, 2$^{nd}$ paragraph. Therefore, reconsideration and withdrawal of the rejection are respectfully requested.

## II.     Rejection Under 35 U.S.C. §102

The Office Action rejects claims 26 and 27 under 35 U.S.C. §102(b) as allegedly being anticipated by Falster. This rejection is respectfully traversed.

Contrary to the Office Action's allegations, claims 26 and 27 are not product-by-process claims. Instead, claims 26 and 27 are method claims that properly depend from independent claim 10. It is well settled that a claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference. *See* MPEP §2131. However, because the Office Action fails to establish that Falster discloses every limitation of claims 26 and 27, the rejection against claims 26 and

27 under 35 U.S.C. §102(b) is improper. Accordingly, reconsideration and withdrawal of the rejection are respectfully requested.

### III. Rejection Under 35 U.S.C. §103

The Office Action rejects claims 10-25 as allegedly having been obvious over Iida in view of Kitamura.[1] By this Amendment, claims 11-13, 15-17, 19-21 and 23-25 are canceled, thereby rendering their rejection moot. As to the remaining claims, Applicant respectfully traverses.

Page 8 of the Office Action alleges that "it would have been obvious for one of ordinary skill in the art at the time of applicant's invention to modify the teachings of Iida...by determining a highest temperature (Tmax) between the crucible and the raw material melt and also providing a heat insulating material between the crucible and a heater in order to stably [grow] a high quality and longitudinal crystal by rotation pulling, as suggested by Kitamura." However, because Iida and Kitamura involve completely different structures and materials, one of ordinary skill in the art would not have combined the teachings of the applied references. Moreover, even the improper combination of Iida and Kitamura would not have led to the subject matter of independent claim 10.

### A. No Reason To Combine The Applied References

Because the two methods as disclosed by Iida and Kitamura involve completely different structures and materials, one of ordinary skill in the art would not have combined the teachings of the applied references.

Kitamura describes an apparatus for producing an oxide single crystal using a double crucible "consisting of an outer crucible made of a noble metal" (such as iridium and

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[1] As confirmed by the Examiner in the brief telephone conference with the Applicant's representative held on July 3, 2008, the indication on page 6 of the Office Action that claims 10-17 are rejected under 35 U.S.C. §103(a) is due to a typographical error. Claims 10-25 are actually rejected under 35 U.S.C. §103(a).

platinum), and a cylindrical inner crucible "having an opening for melt flow and having a small inner diameter," arranged so that the "outer crucible is for supplying a material, and the single crystal is pulled up from the inner crucible and grown." See Abstract and paragraphs [0027], [0077], [0092], [0098] and [0112].

On the other hand, the present application and Iida describe a method for producing a silicon crystal by the CZ method, as follows: A polycrystalline material is put in a quartz crucible and the crucible is heated by a graphite heater to melt the polycrystalline material in the quartz crucible. A seed crystal fixed by a seed holder connected with a lower end of a wire is immersed into the raw material melt melted from the polycrystalline material. Thereafter, the single crystal having a desired diameter and quality is grown under the seed crystal by rotating and pulling the seed crystal. See page 2, line 1 to page 3, line 14 of the present specification. After bringing the seed crystal into contact with the raw material melt, a process called "necking" is performed, by forming a neck portion by narrowing the diameter to about 3 mm. A dislocation-free crystal is then pulled by spreading to a desired diameter. See page 3, lines 4-20 of the present specification.

As described above, because the CZ method is completely different from the method taught by Kitamura, the two methods do not belong to the same technical field, as the Office Action asserts. The Office Action's support for this allegation amount to no more than pointing out broad, generalized similarities between the two methods, such as their common step of pulling up a seed crystal which is contacted with a raw material melt held in a crucible. However, the method of producing the single crystal in each technique and the technical problems associated therewith differ greatly and, therefore, one of ordinary skill in the art would not have combined the teachings of the applied references. Therefore, the combination of the applied references would not have rendered claim 10 and the claims dependent therefrom obvious.

**B.    The Improper Combination Of The References
Would Not Have Rendered The Claims Obvious**

Even the improper combination of the references would not have rendered the claims

obvious.  The Office Action relies on Iida for allegedly describing "controlling a value of V/G

($mm^2$/K • min), including a...desired defect-free region," according to Tmax, as recited by

independent claim 10.  Page 6 of the Office Action alleges that Iida teaches that the "average

temperature gradient at a solid-liquid interface of the single crystal represented by G (K/mm)

wherein the average temperature gradient varies within a temperature range of the silicon

melting point [1414°C] to 1400°C."  Page 7 of the Office Action alleges that by "substituting

a range of temperatures between 1400°C to 1414°C as a (T) in the equations –0.000724 x T +

1.31 and –0.000724 x T + 1.38, a value between 0.119 to 0.121 will be obtained.  Therefore,

[Iida] teaches [that] the single crystal is pulled" with controlling the value of (V/G), as recited

in  claim 10.  However, this assertion is incorrect.  The mathematical expressions recited in

the claims recites Tmax, which is the highest temperature of the raw material melt at an

interface between a quartz crucible inner wall and a raw material melt.  See present

specification at page 15, lines 11-14.  Therefore, Tmax is not the melting point of silicon to

1400°C, as the Office Action assumes.  Moreover, substituting 1414°C and 1400°C for Tmax

in the recited mathematical expressions would yield values between 0.286-0.366.  This range

is considerably higher than the range described by Iida.  Accordingly, contrary to the Office

Action's allegations, Iida fails to teach or suggest that the single crystal is pulled with

controlling the value of (V/G), as recited by independent claim 10.

Additionally, the Office Action admits on page 7 that "Iida...is silent about

determining a highest temperature [(Tmax)] between the crucible and the raw material melt,

as claimed in [claim 10], and also, Iida...[fails] to teach providing a heat insulating material

between the crucible and a heater."

Kitamura fails to cure these deficiencies of Iida. Page 8 of the Office Action alleges that paragraph [0041] of Kitamura describes that "the temperature of the raw material melt at an interface between the crucible inner wall and a raw material melt as (Tmax) controls the temperature gradient (G) of the melt and the amounts of the defects in the single crystal." However, this portion of Kitamura describes that by using a double crucible structure "the change in the temperature of the melt in the inner crucible can be made small, whereby *defects such as growth striations observed in the obtained single crystal can be decreased*" (emphasis added). Accordingly, Kitamura does not teach or suggest Tmax, wherein Tmax "is the highest temperature of the raw material melt at an interface between a quartz crucible inner wall and a raw material melt," as recited in the claims. Therefore, because the applied references, alone or in combination, would not have produced the subject matter of the pending claims, the applied references would not have rendered independent claim 10 and the claims dependent therefrom obvious. Accordingly, reconsideration and withdrawal of the rejection are respectfully requested.

## IV.    Conclusion

In view of the foregoing, it is respectfully submitted that this application is in condition for allowance. Favorable reconsideration and prompt allowance of this application are earnestly solicited.

Should the Examiner believe that anything further would be desirable in order to place this application in even better condition for allowance, the Examiner is invited to contact the undersigned at the telephone number set forth below.

Respectfully submitted,

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WPB:HHS/kxs

Date: July 17, 2008

Attachment: Replacement Sheet

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